Chemistry I: Oxidation Number Rules with Examples

1) All uncombined (free) elements have an oxidation number of zero (0):

E.g.	H_2	O_2	N_2	Ca
Oxidation Number	0	0	0	0

2) Monatomic (1 atom) ion has an oxidation number to its charge:

E.g.	Na^+	K^+	Sr^{2+}	F^-
Ionic Charge	+1	+1	+2	-1
Oxidation Number	+1	+1	+2	-1

3) Fluorine's oxidation number is always -1. Since fluorine is the most electronegative element known, it will always take an electron. This additional electron gives it the -1.

4) The oxidation number of O is -2;
Exception: when it's in a peroxide (O_2^{-2}), its oxidation number is then -1:

E.g.	O_2	H_2O	H_2O_2 (hydrogen peroxide)	NaOH
Ionic Charge of O	0	-2	-1	-2
Oxidation Number of O	0	-2	-1	-2

5) With only a few exceptions, the oxidation number of H is +1:

E.g.	H^+	H^-
Ionic Charge	+1	-1
Oxidation Number	+1	-1 (as the HYDRIDE ion)

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6) Cations from Groups I and II have oxidation numbers equal to +1 and +2, respectively:

E.g.	Na^+	Ba^{2+}	K^+	Mg^{2+}
Ionic Charge	+1	+2	+1	+2
Oxidation Number	+1	+2	+1	+2

7) Second element in a binary compound is assigned the oxidation number it would have if it were a monatomic ion. (Hint: always negative)

8) The sum of all the oxidation numbers in a compound is equal to zero (0):

E.g.	$KMnO_4$	K^+	Mn^{+7}	O^{-2}
Oxidation Numbers	0	+1	+7	-2
TOTAL Oxidation Numbers	0	+1	+7	-8 (4 of them in the compound)
Sum of TOTAL Oxidation Numbers	0			

Math calculation: (1*1) + (1*7) + (4*-2) = 0

9) The sum of all the oxidation numbers in an ion is equal to the charge on the ion:

E.g.	$Cr_2O_7^{-2}$	Cr^{+6}	O^{-2}
Oxidation Numbers	-2	+6	-2
TOTAL Oxidation Numbers	-2	+12 (2 of them in the ion)	-14 (7 of them in the ion
Sum of TOTAL Oxidation Numbers	-2		

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Math Calculation : = (2*6) + (7*-2) = -2

Typical oxidation numbers of common elements. The two tables, below, summarize **some of the representative oxidation states** of some of the elements.

Positive Oxidation Numbers							
Ox #	+1	+2	+3	+4	+5	+6	+7
Examples	H, Na, K, Cu, Ag, Hg, N, Cl, Br, I	Mg, Ca, Sr, Ba, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd, Hg, N, Sn, Pb	Al, Cr, Mn, Fe, Co, N, P, As, Sb, Bi, Cl, Br	C, N, Si, S, Mn, Sn, Pb	N, P, As, Sb, Bi, Cl, Br, I	S, Cr, Mn	Cl, I, Mn, Br

Negative Oxidation Numbers				
Ox #	-1	-2	-3	-4
Examples	H, F, Cl, Br, I	O, S, Se	N, P	C, Si